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Title: Pressurizing Hagan and SAVY containers to 30-psig (air) to measure the release of analytical cerium oxide test powder

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Pressurizing Hagan and SAVY containers to 30-psig (air) to measure the release of analytical cerium oxide test powder

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Summary / Abstract:

In response to an ESS surrounding the storage of sealed sources at TA-55, personnel from RP-SVS (Radiation Protection Services) and ORI-2 (Operational Readiness & Execution) were approached by ES-55 (Facility System Engineering) to provide technical testing of known nuclear material storage containers. Testing criteria were determined by SB-PF (Safety Basis for Plutonium Facilities). Tests were conducted in conjunction with multiple related projects at the Aerosol Sciences Laboratory (TA-03-0130-0103). An experimental system was quickly developed to deliver a pressure pulse (30-psig) that mimics a sealed source burst scenario. A series of twelve tests was conducted. Six tests were done with two different 5QT SAVY-4000 containers, where each SAVY filter-lid combination was subjected to three successive test insults. Three tests were done with a (0.375" diameter filter) 8QT Hagan container, and three tests with a (0.625" diameter filter) 8QT Hagan container. An unused, fresh container filter was used for each tested Hagan container, each receiving only one test insult per filter. Cerium oxide (CeO_2) powder was loaded (100 grams per test) into a nozzle in the tested Hagan and SAVY containers, and the nozzle was hard-plumbed to a ball valve and a pressure source. This system was installed into the Los Alamos RRFMC (Respirable Release Measurement Chamber), which is an integrated multipurpose aerosol wind tunnel that satisfies NQA-1 subpart 2.4 for R&D work. The ball valve was fitted with a mechanical linkage for operation from outside the wind tunnel. An aerodynamic particle sizer counted the particle concentrations and size distributions of released aerosol. Respirable aerosol released during the tests was measured and a correction factor for wind tunnel flowrate and internal duct deposition was applied.

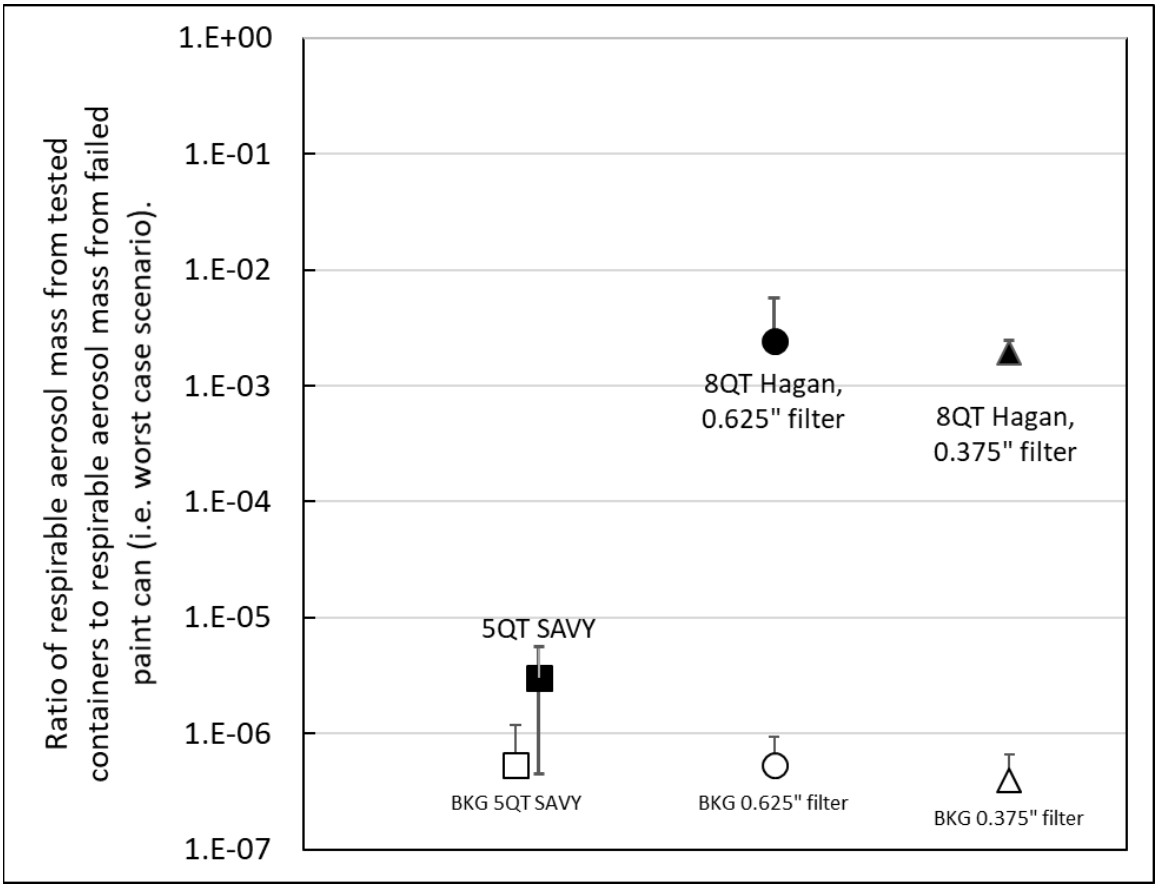
For the tested Hagan and SAVY containers with an initial powder load of 100 g, there was zero released mass (0.0±0.1 g before and after the pressure tests). Therefore, less than 0.1% of the powder test mass was released. An aerosol particle counter measured the respirable and airborne aerosol in the Los Alamos RRFMC (Respirable Release Fraction Measurement Chamber).

Summary table for SAVY and Hagan containers (net released, respirable and airborne masses).

Because the test mass was 100 g of powder, these gram quantities are also the "percent" values.	**Net released mass[1], g**	**Net respirable mass[2], g**	±	**Uncertainty respirable mass (net)[2], g**	**Net airborne mass[2], g**	±	**Uncertainty airborne mass (net)[2], g**
5QT SAVY Avg and Combined Uncertainty	**0.0 ± 0.1 g**	**2.16E-06**	±	**6.71E-06**	**2.16E-06**	±	**6.71E-06**
8QT Hagan 0.625-dia filter. (Average and Combined Uncertainty)	**0.0 ± 0.1 g**	**2.32E-03**	±	**5.26E-03**	**2.36E-03**	±	**5.33E-03**
8 QT Hagan 0.375-dia filter (Average and Combined Uncertainty	**0.0 ± 0.1 g**	**1.25E-03**	±	**2.23E-03**	**1.33E-03**	±	**2.40E-03**

(1) Measured with a Model SR64001 mass balance (Mettler Inc. (Columbus OH).
(2) Measured with a Model 3321 APS Aerodynamic Particle Sizer (TSI Inc Shoreview MN).

The released respirable mass amounts were compared to a worst-case test with a two-gallon crimp seal pail. In that test, the crimp seal lid failed under a 30-psig pressure pulse, with 0.72 g of net respirable aerosol (< 10 µm AED, aerodynamic equivalent diameter).



Summary figure. The ratio of released respirable mass from the Hagan (about 10^{-3}) and SAVY (about 10^{-6}) containers compared to the released respirable mass of 0.72 g from a two-gallon Cary Co. crimp seal pail.

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Introduction:

The need to pressure-test known nuclear material storage containers has been made apparent by the CSE (cognizant systems engineer) assigned to containers at TA-55. The main goal of the pressure tests in the current study is to understand if the SAVY-4000 and Hagan containers are robust enough to withstand a 30-psig over-pressurization.

Materials and Methods:

An experimental system was developed to deliver a pressure pulse that mimics a sealed source burst scenario. A series of twelve tests was conducted, six tests with 5 QT SAVY-4000 and six tests with 8 QT Hagan containers (Table 1). Note that two different SAVY lids were subjected to three successive test insults, while the Hagan container filters only received one test insult per filter (Table 1). Before the tests, the filters were visually inspected, and all containers, lids and O-rings were in good physical condition.

Table 1. Two different SAVY lids were subjected to three test insults. Hagan container filters only received one test insult per filter. The test indices correspond to the data filenames for this work.

Test indices for the 30-psig pressurizations	**Container type and lid ID number**
SAVY 1st, 2nd, 3rd	5QT SAVY; Lid # 081305135L
SAVY 4th, 5th, 6th	5QT SAVY; Lid # 012005142L
Hagan 0.625” filter (one test per filter) 2nd, 3rd, 4th	8QT Hagan NUCFIL-019 2-08 LANL 3012
Hagan 0.375” filter (one test per filter) 1st, 5th, 6th	8QT Hagan NUCFIL-013 10-02 LANL 2062

Figure 1. Cerium oxide powder inside a SAVY container before pressurization test.

Cerium oxide (CeO_2) powder was loaded into a nozzle that was fixed inside of each container (Figure 1). Powder masses were tare-weighed (Table 2) on a Mettler Inc. (Columbus OH) model SR64001 mass balance (Los Alamos S&CL ID #028289, calibration due 4-27-2021). The rated instrument uncertainty is ±0.1 g. The same mass balance was used to weigh the tested containers after the pressurization tests.

Table 2. Tested containers were loaded with cerium oxide test powder.

Container	MAR(g)
1st SAVY	100.0
2nd SAVY	100.2
3rd SAVY	100.2
4th SAVY	100.0
5th SAVY	100.5
6th SAVY	100.8
(2nd Hagan 0.625-dia)	100.9
(3rd Hagan 0.625-dia)	99.7
(4th Hagan 0.625-dia)	100.0
(1st Hagan 0.375-dia)	100.3
(5th Hagan 0.375-dia)	100.2
(6th Hagan 0.375-dia)	100.0

A 47 mm filter holder (model RVPH-20 HI-Q Inc San Diego CA) with a honeycomb backing mesh (4 mm diameter openings) was used to support a stainless steel mesh (Fisher Sci 59-004648-0010) screen (125 µm holes, and 23% open area fraction). The RVPH-20 filter holder has a 42 mm effective diameter, but the custom nozzle flares out to an opening with a 47 mm diameter (Figures 2 and 3). Note the direction of air flow in the nozzle (for these tests) is reverse to the intended direction, if this were an air sampling application.

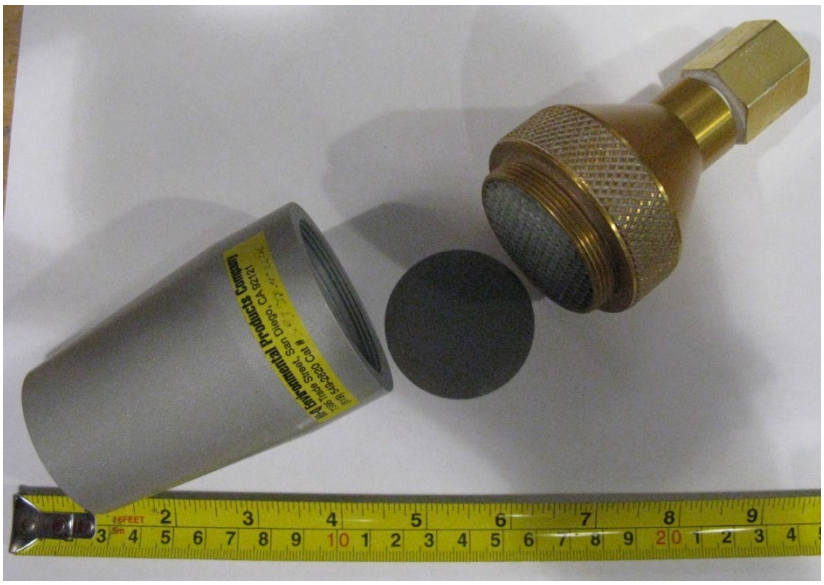


Figure 2. HI-Q Inc 47 mm filter holder, steel mesh screen and custom 47 mm diameter nozzle.

Figure 3. Assembled nozzle system.

The containers were attached (Figure 4) to an intermediate (ASME rated) pressure vessel (Drierite Inc model 106-C) and installed (Figure 5) into the Los Alamos RRFMC (Respirable Release Measurement Chamber).

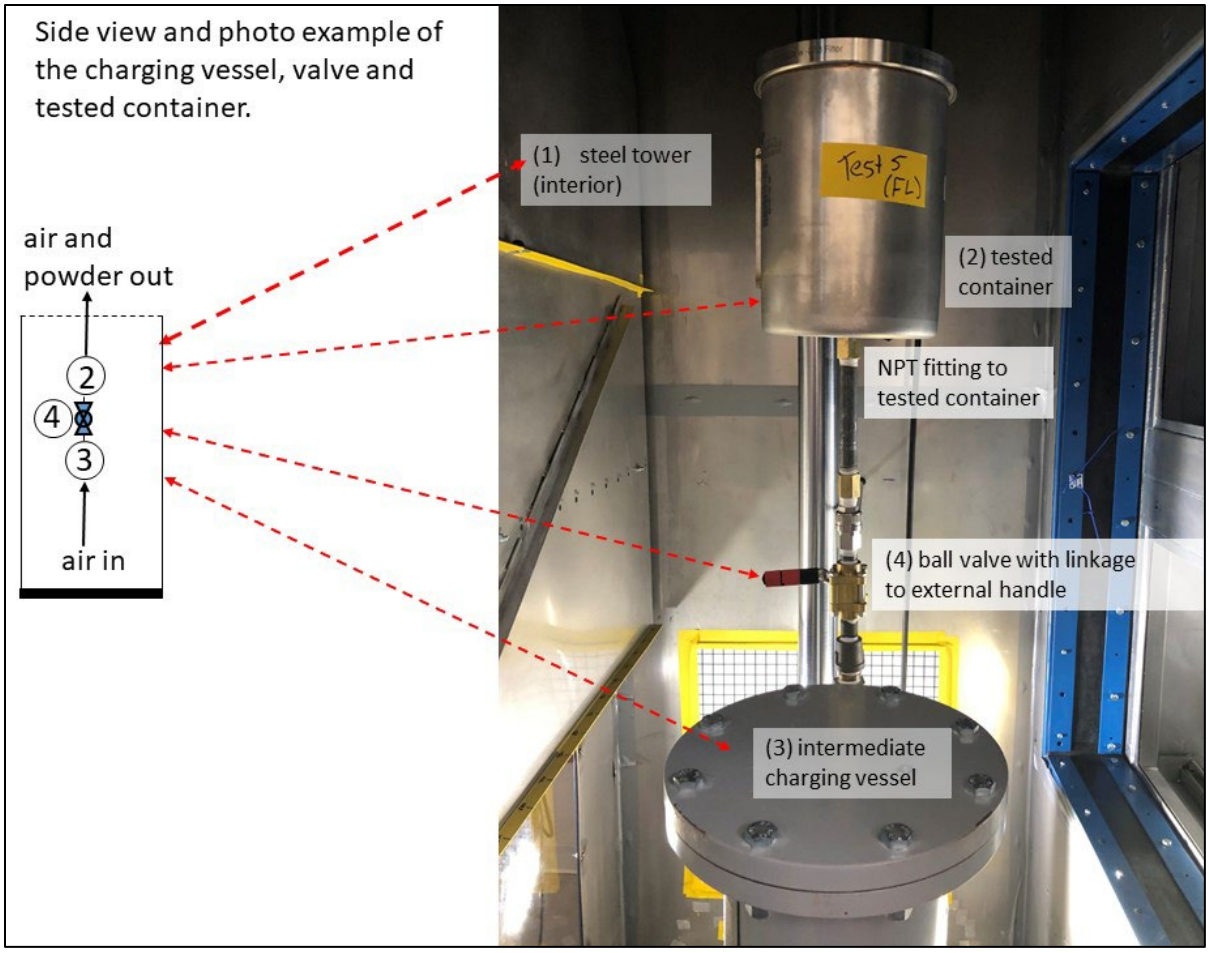


Figure 4. Intermediate charging vessel, ball valve and test container.

The RRFMC (Moore Tao and Karns 2018) is an experimental drop tower system (Figure 5) integrated into a HEPA filtered aerosol wind tunnel that satisfies NQA-1 subpart 2.4 for R&D work. It drop-tests nuclear material storage containers loaded with cerium oxide powder and measures the released respirable (< 10 µm AED, aerodynamic equivalent diameter) aerosol and airborne (< 20 µm AED) aerosol with an APS (Aerodynamic Particle Sizer) unit (TSI Inc. Shoreview MN).

Net aerosol mass measured by the system is:

$$\mathrm{m(aerosol)} = \mathrm{C_P}\left(\frac{\mathrm{g}}{\mathrm{m^3}}\right) * \mathrm{FR}\left(\frac{\mathrm{m^3}}{\mathrm{min}}\right) * \mathrm{T_S(min)} \qquad \text{Eq. 1}$$

C_P = respirable or airborne aerosol concentration measured by the APS system, corrected for aerosol deposition losses in the wind tunnel (g/m^3),
FR = RRFMC total air flow rate, measured in the duct upstream of the APS (m^3/min), and,
Ts = APS sampling interval (1 min).

After the container was loaded in the HEPA filtered RRFMC wind tunnel, the access door was closed and the APS (Figure 6) was started before the pressure pulse test to gather

background aerosol measurements and establish a baseline. The intermediate pressure vessel was charged to slightly more than the 30-psig test value, with allowance for the combined volumes of the intermediate vessel and the tested container. To pulse the container and evacuate the CeO_2 test powder out of the nozzle, a ball valve was manually cycled (opened and closed) using a mechanical linkage from outside the drop tower. The combined volume of the intermediate vessel and the tested container would equilibrate to the 30-psig test pressure, and the APS then measured any released aerosol in the downstream portion of the wind tunnel.

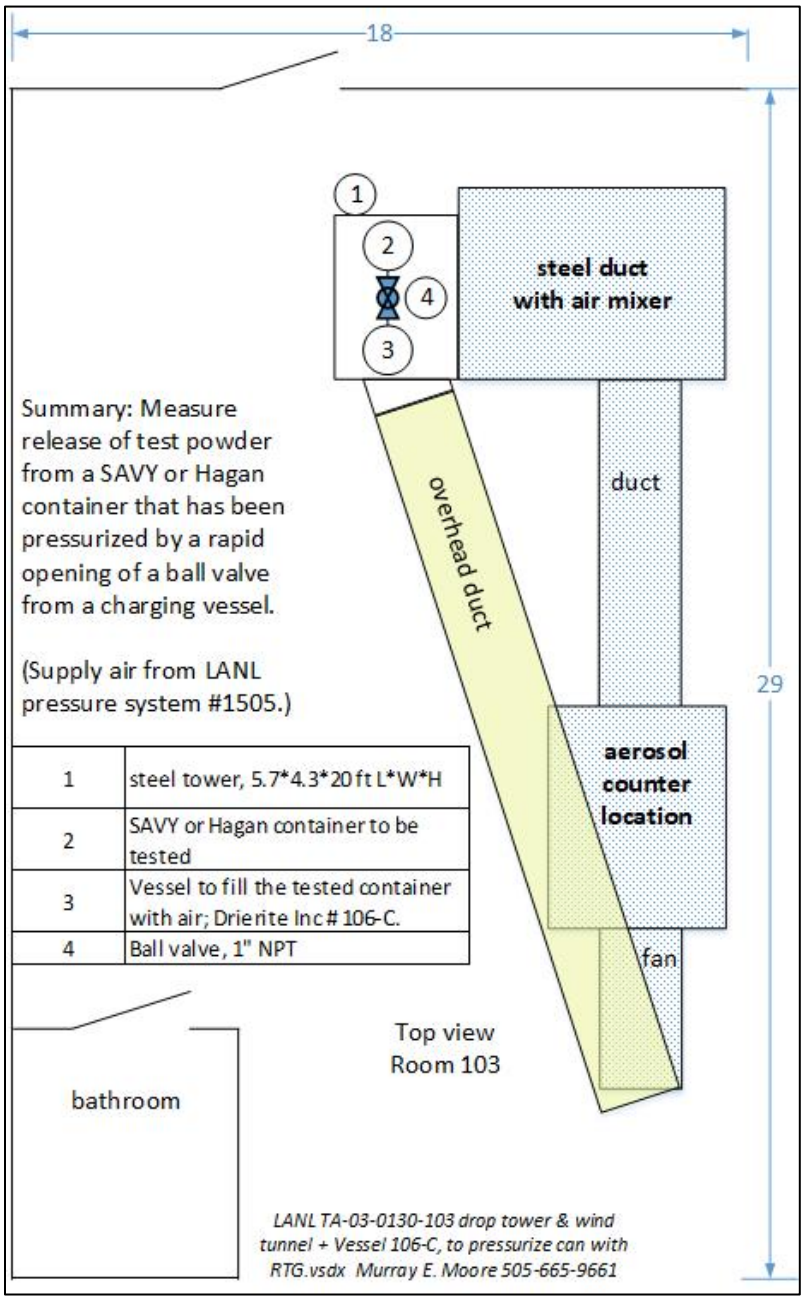


Figure 5. Tests conducted in the LANL RRFMC (Respirable Release Fraction Measurement Chamber).

Figure 6. TSI Inc. model 3321 APS Aerodynamic Particle Sizer

The RRFMC drop tower has been specifically designed to conduct a variety of container drop tests. It has an integrated pressure system, with an approved LANL ID number, and its individual components are operationally pressure rated. For these pressurized powder tests, the existing Drierite 106-C air drier (already contained in the pressure system) was repurposed (it is an ASME-rated pressure vessel) as the intermediate charging vessel for safe operation of these tests. The Drierite 106-C is normally used to supply ultra-dry airflow for experiments involving liquid droplet aerosol generation. Liquid droplet aerosol generation was not relevant to these tests, and the drop tower was quickly retrofitted for the pressure pulse testing activities. This preparation period (i.e. four weeks) allowed for a timely gathering of test data.

The first pressurized powder test used a two gallon pail (Cary Co. model #26W098) with a 1-mm diameter orifice in the lid of the pail (Figure 7). A 0.5-mm diameter orifice would have the same pressure drop characteristics as a nominal Hagan or SAVY filter, i.e. about a 0.6 inWC (inches of water column) for an airflow rate of 0.2 ALPM. For this current project, only an orifice of 1-mm diameter was possible, given the time allowed for this effort.


Figure 7. Two gallon (#26W098) pail (Cary Co., Addison IL)

Results:

Note all of the Hagan and SAVY containers (Table 2) had zero measured released mass (0.0±0.1 g before and after the pressure tests) as measured by the Mettler™ mass balance (Summary table and Table 3). Compared to the nominal test powder MAR mass of 100 g, less than 0.1% of the powder test mass was released.

For the 2 gallon Cary container (Figure 8A and 8B), with the 100.0 g test load of powder, the container lid was dislodged (Figure 8C), 42.5 g of powder was retained in the container (Figure 8D), and the total released mass value was 57.5 g.

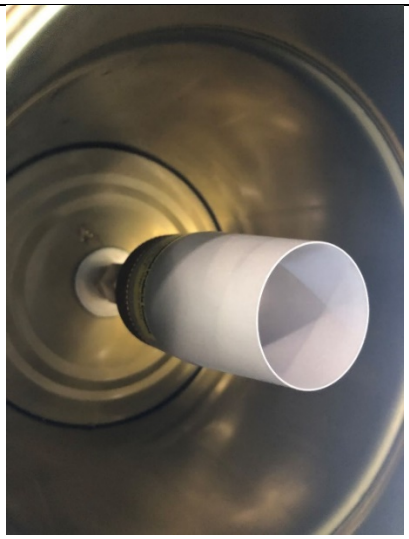


Figure 8A.

Figure 8B.

Figure 8C.

Figure 8D.

Figure 8. Photos of the Cary(TM) can before the test (8A), after the test (8B), the lid after the test (8C) and measurement of the powder retained in the container (8D).

The APS system produces tabular and graphical outputs of aerosol particle size and mass concentrations. Figures 9 and 10 give a snapshot from one Hagan container, and Figures 11 and 12 are from one of the SAVY tests.

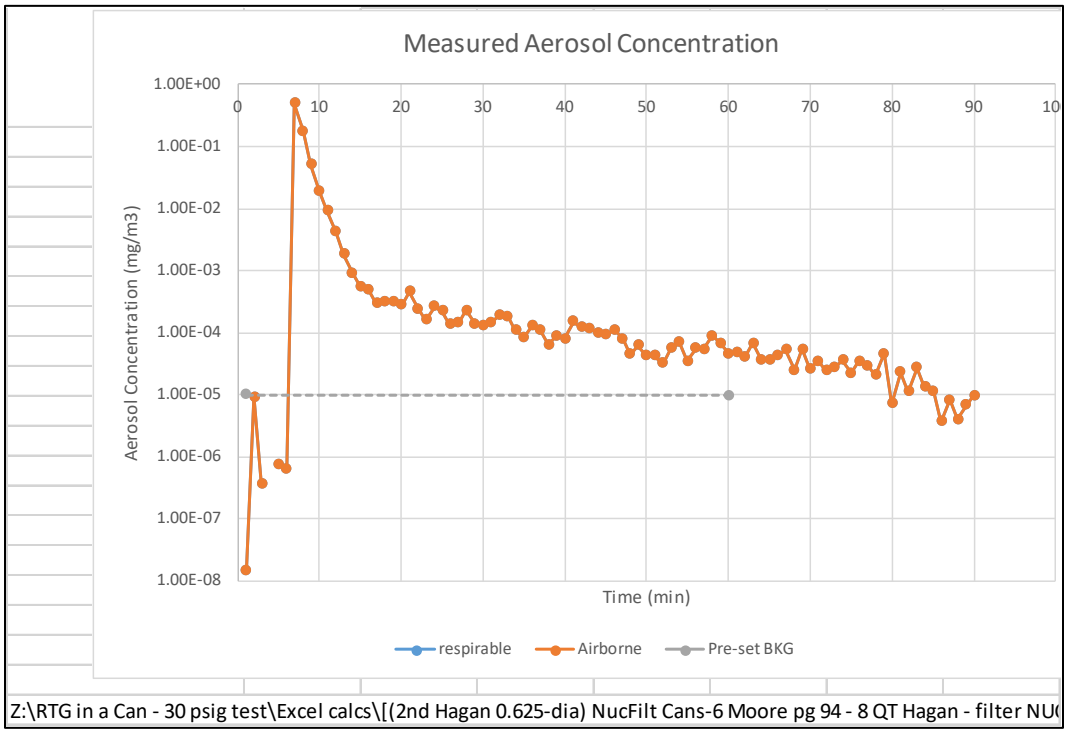


Figure 9. Aerosol concentration versus time after the test (7 min mark) for the “2nd tested Hagan”.

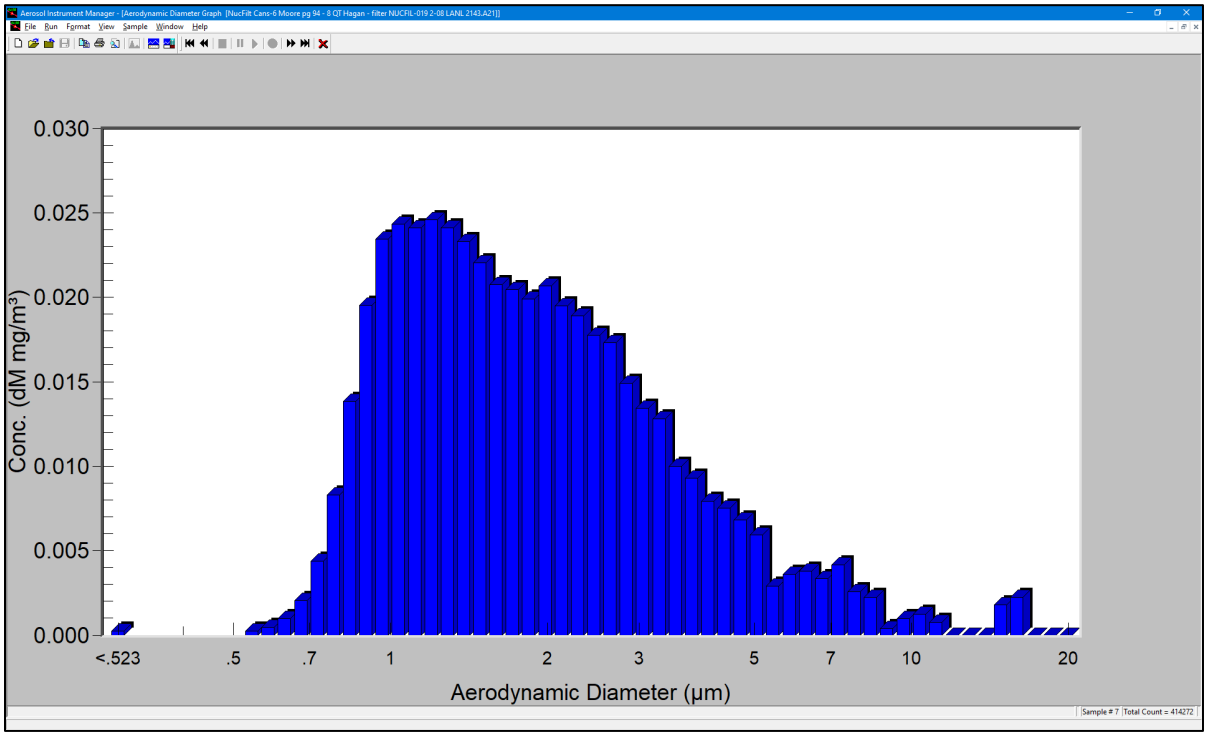


Figure 10. Aerosol concentration versus aerodynamic diameter (7 min mark) for the “2nd tested Hagan”.

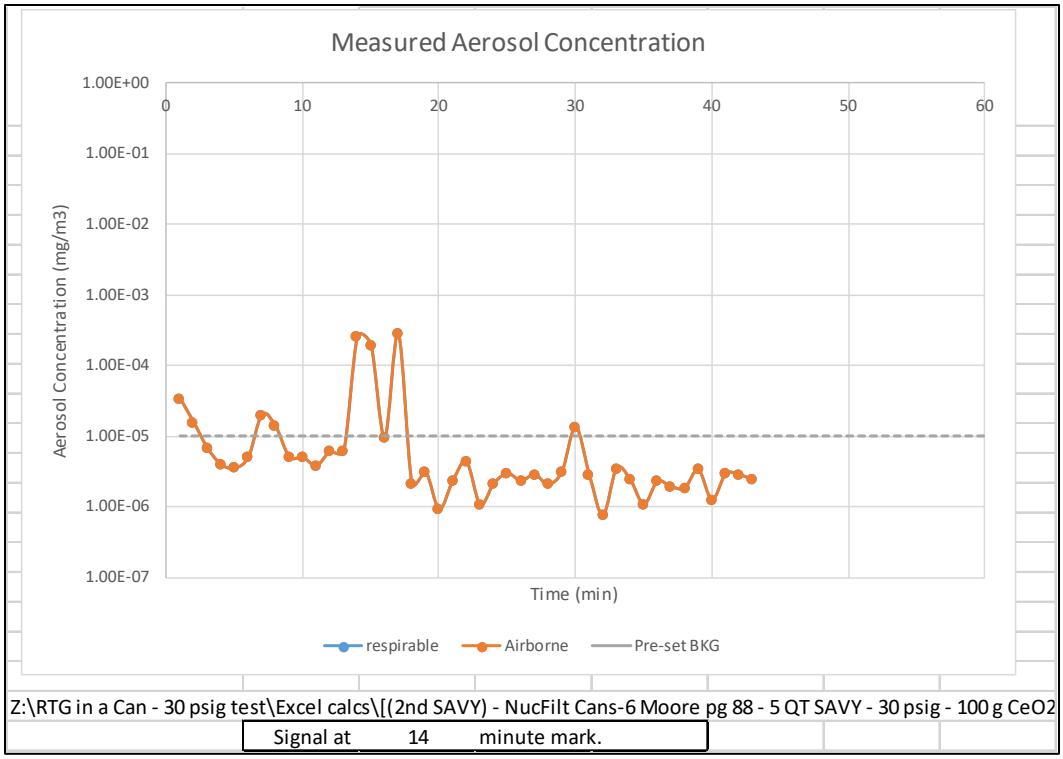


Figure 11. Aerosol concentration versus time after the test (7 min mark) for the “2nd tested SAVY”.

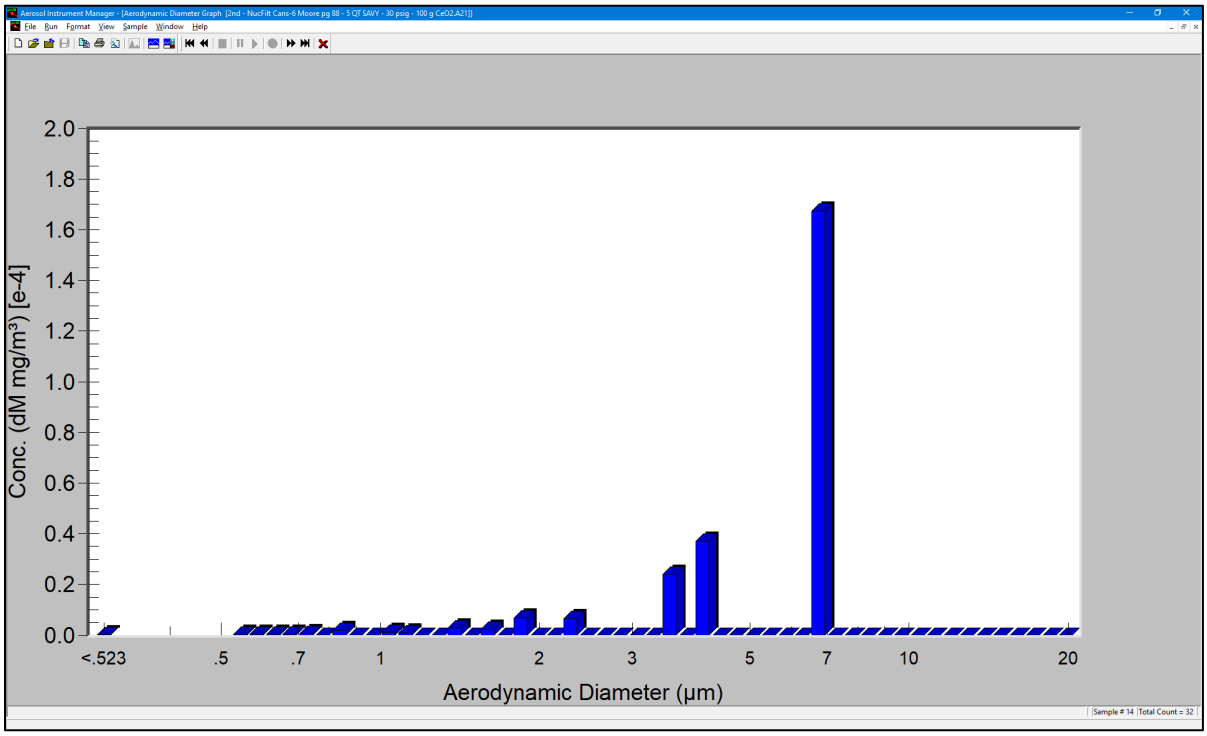


Figure 12. Aerosol concentration versus aerodynamic diameter (7 min mark) for the “2nd tested SAVY”.

The APS measurements were used to produce estimates of the net respirable and net airborne mass (Table 3).

Table 3. Estimate measurements of the respirable and airborne mass, based on Equation 1.

Because the test mass was 100 g of powder, these gram quantities are also the "percent" values.	**Net released mass[1], g**	**Net respirable mass[2], g**	±	**Uncertainty respirable mass (net)[2], g**	**Net airborne mass[2], g**	±	**Uncertainty airborne mass (net)[2], g**
5QT SAVY Avg and Combined Uncertainty	**0.0 ± 0.1 g**	**2.16E-06**	±	**6.71E-06**	**2.16E-06**	±	**6.71E-06**
8QT Hagan 0.625-dia filter. (Average and Combined Uncertainty)	**0.0 ± 0.1 g**	**2.32E-03**	±	**5.26E-03**	**2.36E-03**	±	**5.33E-03**
8 QT Hagan 0.375-dia filter (Average and Combined Uncertainty	**0.0 ± 0.1 g**	**1.25E-03**	±	**2.23E-03**	**1.33E-03**	±	**2.40E-03**

(1) Measured with a Model SR64001 mass balance (Mettler Inc. (Columbus OH).
(2) Measured with a Model 3321 APS Aerodynamic Particle Sizer (TSI Inc Shoreview MN).

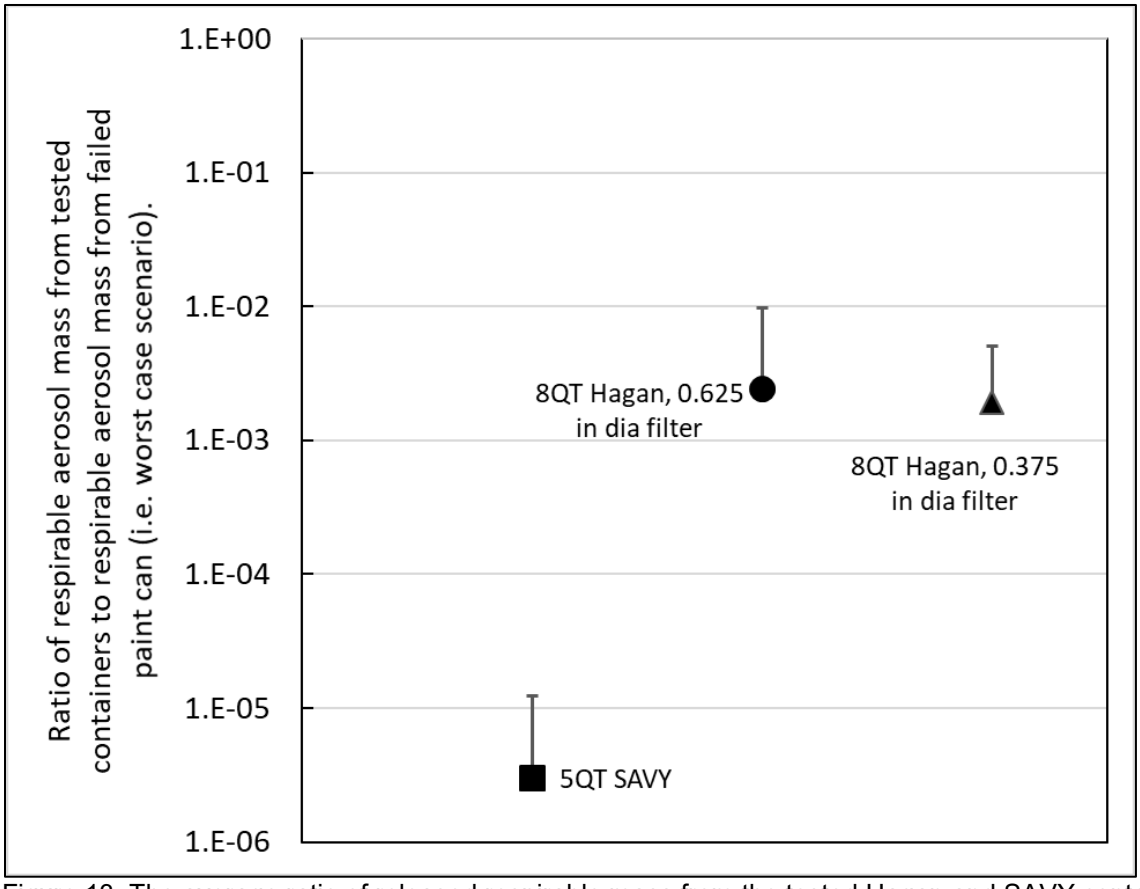


Figure 13. The average ratio of released respirable mass from the tested Hagan and SAVY containers compared to the released respirable mass of 0.72 g from a two-gallon Cary Co. pail (Table 4).

Table 4. Summary of pressure pulse tests at 30-psig for Hagan and SAVY containers.

SUMMARY. RESPIRABLE MASS RATIO **Ratio of measured respirable aerosol mass from the tested containers, divided by the respirable aerosol mass (0.72 g) from a two-gallon Cary Co. crimp seal pail (i.e. worst case scenario).**			
Test	**Ratio**		**Standard Deviation**
5QT SAVY	3.02E-06	±	9.37E-06
8QT Hagan, 0.625 in dia filter	2.43E-03	±	7.34E-03
8QT Hagan, 0.375 in dia filter	1.91E-03	±	3.12E-03

	Net respirable mass, g	±	**Uncertainty respirable mass (net), g**		**Net airborne mass, g**	±	**Uncertainty airborne mass (net), g**
2 gallon can, 1 mm orifice. Lid dislodged.	**7.16E-01**	±	**8.60E-02**		**8.79E-01**	±	**1.04E-01**

Discussion and Conclusions:

From a structural standpoint, the SAVY-4000 and the Hagan container performed very similarly. After the 30-psig test pulses, there were no visual indications of bulging of the container body in either container type. The SAVY-4000 container was tested in other pressure related work at New Mexico Tech, where the container was exposed to pneumatic and hydrostatic pressure insults. In those tests, the SAVY-4000 containers began showing visual signs of plastic deformation at approximately 60-psig from internal pressure insults. Since this current work did not approach that internal 60-psig pressure, we were confident that complications would not arise.

However, we did not have the same history for the Hagan, as this specific type of "pressure pulse" test had never been conducted. In the current test, the Hagan still performed well in this respect, and did not indicate deformation or bulging for an estimated force of 1,100 lbf on the internal face of each lid.

For all the tests, this force impulse did not have an apparent negative effect on the structural performance. This is a key result, as the pressure pulse did not permanently disfigure the sealing surfaces and method of closure, therefore maintaining and reproducing the performance of their respective design functions. Upon completion of each test, the sealing surfaces of each container were inspected for damage, unrecoverable debris lodged in the filter media, and general damage to the filter media etc.

The Hagan filter media is an area of concern when evaluating the complete container performance. In the current tests, both of the SAVY and Hagan filters captured the expelled surrogate material with differing levels of effectiveness and the filter media remained intact. In the case of the Hagan, the carbon fiber media is directly exposed to the incoming powder in a single circular cross section. However, the physical impact of the powder did not dislodge any visible piece of the filter media, and the filter components retained their structural rigidity.

In the SAVY container, the filter material has less direct exposure to powder because of the recessed smaller holes in the filter cup. During the pressure pulse tests, powder impacted onto the filter media during the tests. The small diffusion holes in the filter cup assembly allowed multiple locations for the test powder to cling to the filter material. Impacted powder was removed after tests two and three, and tests five and six respectively. However, even with a HEPA-filtered vacuum cleaner, there were small amounts of material that could not be removed. This powder was not observed to build up and clog the filter during the subsequent tests. This topic has been an area of concern in the past regarding filter performance due to corrosion inside of the container during normal storage conditions inside the plant.

Overall, the results match many of the known performance characteristics of the two containers that were tested. The SAVY-4000 allowed the passage of about 10^{-6} of the challenge powder material (compared to the 0.72 g of powder measured in the worst-case test). The Hagan allowed the passage of about 10^{-3} of the challenge powder material.

The LANL facility operations and safety basis personnel can utilize this information to determine if these containers are viable storage systems. The performance of these containers is important for laboratory safety, and this information is valuable for the container designers to ensure a viable and reliable product for the TA-55 PF-4 facility and for the DOE complex at large.

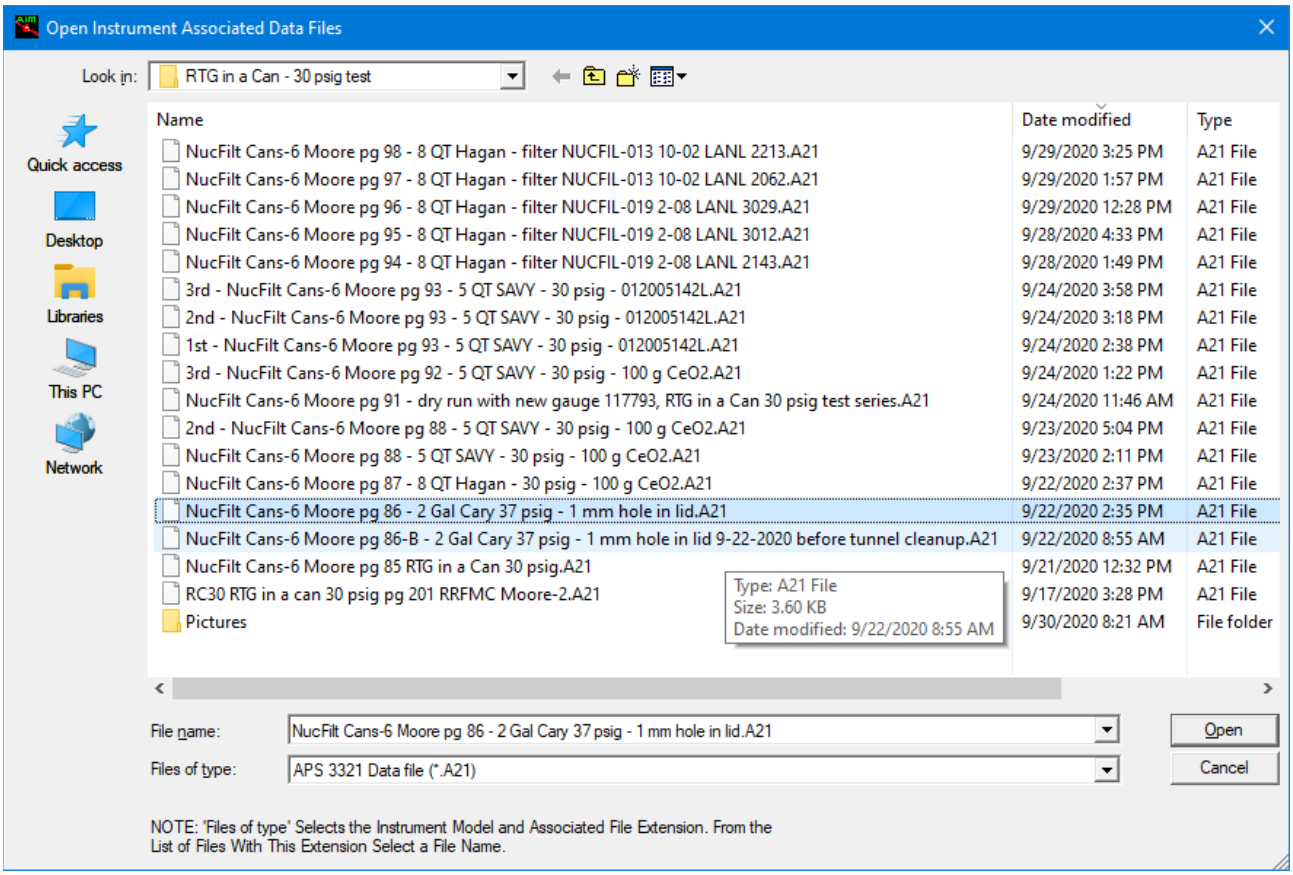
References

Moore ME, Tao Y and Karns T. 2018 Respirable Release Fraction Measurement Chamber (RRFMC) specification sheet. Los Alamos National Laboratory Unrestricted Release. LAUR-18-31809.

Tao Y and ME Moore. 2018. Measuring Monodisperse Aerosol Transmission in the Los Alamos Respirable Release Fraction Measurement Chamber. 63rd Health Physics Soc. Cleveland OH. Los Alamos National Laboratory Unrestricted Release. LA-UR-25745.

Appendices

Ratio of measured respirable aerosol mass from the tested containers, divided by the respirable aerosol mass from a failed paint can (i.e. worst case scenario).			
Test	**Ratio**		**Standard Deviation**
1st SAVY	1.24E-06		N/A
2nd SAVY	7.90E-06		N/A
3rd SAVY	2.50E-06		N/A
4th SAVY	3.16E-06		N/A
5th SAVY	6.38E-07		N/A
6th SAVY	2.67E-06		N/A
5QT SAVY	3.02E-06	±	9.37E-06
(2nd Hagan 0.625-dia)	7.07E-03		N/A
(3rd Hagan 0.625-dia)	1.74E-03		N/A
(4th Hagan 0.625-dia)	9.19E-04		N/A
8QT Hagan, 0.625 in dia filter	2.43E-03	±	7.34E-03
(1st Hagan 0.375-dia)	1.15E-03		N/A
(5th Hagan 0.375-dia)	1.78E-03		N/A
(6th Hagan 0.375-dia)	2.29E-03		N/A
8QT Hagan, 0.375 in dia filter	1.91E-03	±	3.12E-03



The TSI Inc. APS Aerodynamic Particle Sizer generates data files with a *.A21 format extension.

1ST -SAVY Ø113Ø5ØØ6B LID-Ø813Ø5135L Using drop tower punchlist.
Nuclfilt CANS-6 Moore p 88-5QT SAVY-30 psig - 100g CeO2 (A21)

Container drop information sheet RTG in CAN series.

Room and windtunnel information (the same for the dummy and also the tested container) PG 88

[2]	Date: 9-23-20 1st FIRST SAVY TEST	Operator: MOORE	Logbook name & page: Moore Nuclfilt HL
[5]	Room AC/heater setpoint T(°F) —		Room Temp. T(°F) —
[6]	(optional) Tunnel AC/heat setpoint T(°F) —		
[7]	(optional) Humidifier setpoint RH% —		
[8]	T(°F) LANL TA-6 —	RH% LANL TA-6 —	Time of LANL TA-6 data —
[13]	Wind Tunnel Speed, Hz 24 Hz		
[14]	Air Velocity at location #4, m/s		Flow Rate at location #4, m^3/s
[15]	Tunnel Temp. T(°F)		Tunnel Humidity RH%

Dummy Container Information (for measuring RRFMC background)

[9]	Dummy container type:				
[9]	Total weight of dummy container:				
[10]	Drop orientation:		Angle before drop		
Letter	***SAR Orientation***	*Letter*	***SAR Orientation***	*Letter*	***SAR Orientation***
A	*CG over top corner*	*D*	*Top down on handle*	*G*	*Bottom down flat*
B	*CG over bottom corner*	*F*	*Top down flat*	*H*	*Slap down*
C	*Side*				

BKG before test ~ 2×10^{-5} mg/m3

[17]	Dummy container sampling schedule for aerosol particle counter:	
[22]	Tape measure, T(in)= Platen offset, P = 17 in	Drop height, T-P = H + ΔH =
[32]	Filename of aerosol particle counter for dummy drop: —	
[37]	Post-test dummy observation:	

Tested Container Information (requires a new, second punchlist)

[9]	Container type and serial number:	
[9]	Container Size:	
[9]	Type note: no lid?	
[9]	Payload description:	
[9]	MAR CeO2 mass (g):	Container mass w/o CeO2 (g):
[9]	Container mass w/ CeO2, m1(g):	
[10]	Drop Orientation:	Angle before drop
[17]	Tested container sampling schedule for aerosol particle counter:	
[22]	Tape measure, T(in)= Platen offset = 17 in; Drop height, T-P = H + ΔH =	
[29]	Sample number of the aerosol particle counter at the drop:	
[32]	Filename of aerosol particle counter for tested container:	
[32]	Filename in hi-speed camera 1:	
[32]	Filename in hi-speed camera 2:	
[34]	Container mass after drop, m2(g):	
[34]	m(released) = m1-m2, (g) =	DR=Damage Ratio, (m1-m2)/MAR =
[35]	DR Filter weight before, g:	DR filter weight after, g:
[37]	Post test container observation:	

Z:\Drop tester - RRFMC\Operation procedure\RP-SVS-RIC-TR-100-R1 RRFMC updated procedure 2020\[RRFMC punch list -2020.xlsx]Sheet1

Tower & container cleaning steps

	Preliminary Steps	Note	Operator number*	Assistant number
1	Spray silicone into HEPA cabinet & generic mixer			
2	Wipe RRFMC floor with clean cotton cloth			
3	Wipe the test container with a damp paper towel			
4				

First SAVY Test

First SAVY Test

2ND SAVY Ø113Ø5ØØ6B LID-Ø813Ø5135L using drop tower punchlist.
2nd - Nucfilt-6 Moore p. 88 5QT SAVY-30 psig - 100g CO2 .A21
RTG in CAN series

Container drop information sheet

Room and windtunnel information (the same for the dummy and also the tested container)

[2]	Date: 9-23-2020 2ND SAVY TEST	Operator: MOORE	Logbook name & page: p. 88 Nucfilt #6
[5]	Room AC/heater setpoint T(°F)		Room Temp. T(°F)
[6]	(optional) Tunnel AC/heat setpoint T(°F)		
[7]	(optional) Humidifier setpoint RH%		
[8]	T(°F) LANL TA-6	RH% LANL TA-6	Time of LANL TA-6 data
[13]	Wind Tunnel Speed, Hz		
[14]	Air Velocity at location #4, m/s		Flow Rate at location #4, m^3/s
[15]	Tunnel Temp. T(°F)		Tunnel Humidity RH%

Dummy Container Information (for measuring RRFMC background)

[9]	Dummy container type:				
[9]	Total weight of dummy container:				
[10]	Drop orientation:			Angle before drop	
Letter	***SAR Orientation***	*Letter*	***SAR Orientation***	*Letter*	***SAR Orientation***
A	*CG over top corner*	*D*	*Top down on handle*	*G*	*Bottom down flat*
B	*CG over bottom corner*	*F*	*Top down flat*	*H*	*Slap down*
C	*Side*				

[17]	Dummy container sampling schedule for aerosol particle counter:		
[22]	Tape measure, T(in)=	Platen offset, P = 17 in	Drop height, T-P = H + ΔH =
[32]	Filename of aerosol particle counter for dummy drop:		
[37]	Post-test dummy observation:		

Tested Container Information (requires a new, second punchlist)

[9]	Container type and serial number:		
[9]	Container Size:		
[9]	~~Type note: no lid?~~ PULSE ΔP ON #13		
[9]	Payload description:		
[9]	MAR CeO2 mass (g):		Container mass w/o CeO2 (g):
[9]	Container mass w/ CeO2, m1(g):		
[10]	~~Drop Orientation:~~ PULSE ON SAMPLE 6		~~Angle before drop~~
[17]	Tested container sampling schedule for aerosol particle counter:		per #6 ΔP PULSE
[22]	Tape measure, T(in)=	Platen offset = 17 in; Drop height, T-P = H + ΔH =	
[29]	Sample number of the aerosol particle counter at the drop:		lesson learned -
[32]	Filename of aerosol particle counter for tested container:		conduct correct
[32]	Filename in hi-speed camera 1:	valve sequence on compressor	
[32]	Filename in hi-speed camera 2:	slap #3	
[34]	Container mass after drop, m2(g):		
[34]	m(released) = m1-m2, (g) =		DR=Damage Ratio, (m1-m2)/MAR =
[35]	DR Filter weight before, g:		DR filter weight after, g:
[37]	Post test container observation:		

Z:\Drop tester - RRFMC\Operation procedure\RP-SVS-RIC-TR-100-R1 RRFMC updated procedure 2020\[RRFMC punch list -2020.xlsx]Sheet1

Tower & container cleaning steps

	Preliminary Steps	Note	Operator number*	Assistant number
1	Spray silicone into HEPA cabinet & generic mixer			
2	Wipe RRFMC floor with clean cotton cloth			
3	Wipe the test container with a damp paper towel			
4				

Second SAVY Test

Second SAVY Test

3RD - SAVY - 5QT - 01130500GB LID - 03130513S2 using new punchlist for pressurized powder

Operation procedure punchlist and container information sheet. (RTG in a can - 30 psig series)

	Preliminary Steps	Note	Operator number	Assistant number
1	Walk through room 103 and organize work area.		1	
2	Record the date, operator, logbook name & page.		1	
3	Record serial number and volume of test can.	(below)	1	
4	Note room temp (deg F).	73		
5	Open Z:\RTG in a Can - 30 psig test\RTG in a Can - 30 psig - R1.xlsx	R2 Moore ME 2020 RTG in a Can-30 psig test.xlsx		
6	Calculate charging pressure for gray 9 gallon Drierite 106-C vessel for 30 psig pulse.		1	
7	Note charging pressure (psig):	Pressure (psig): 34		
8	Ensure vessel 106-C will not initially be pressure charged.		1	
9	Note valve V5 is open, to not charge vessel 106-C.		1	
10	Note valve V6 is closed, to not charge vessel 106-C.		1	
	In Process Steps			
11	Prepare container to be tested.		1	2
12	Install test can above ball valve on vessel 106-C.			2
13	Close and lock tower door. Seal with "In Use" yellow tape.			2
14				
15	Turn on air compressor.			2
16	Adjust regulator PCV1 and use PRV1 to set and note charging pressure:	IF needed		2
17	Set and record wind tunnel speed (Hz):		1	
18				
19	Note valve V5 is closed, to charge vessel 106-C.			2
20	Note valve V6 is open, to charge vessel 106-C.			2
21	Verify gray vessel Drierite 106-C is pressurized.			2
22	Verify charging (system) pressure on PI3: 38 36	Pressure (psig): 38 36		
23		corrected by Moore after Davis comment		
24	Turn aerosol particle counter on.		1	
25	Start AIM software for drop test sampling (60 sec count, 90 count cycles)	1:08:00	1	
26	Pre-drop BKG concentration validation. Note five cycles of 1 minute.	5×10^{-5}, 5×10^{-5}, 2×10^{-5}, 2×10^{-5}, 1×10^{-4} 2×10^{-5} @6th		
27	Create filename w/format Test series; logbook & page. option FD info.			
28	Toggle ball valve above gray vessel Drierite 106-C for a one to two second pulse.			
29	Note sample number of aerosol particle counter: 7th	Sample number at pulse: 7th		
30				
	Post-test Steps			
31	Save data files, record file names and location			
32	Verify background is about 1.0E-5 mg/m^3 before opening door.			
33	Open RRFMC door			
34	(Optional) DR measurement			
35	(Optional) DR Measurement filter.			
36	Turn air compressor off — Open bleed valve.			
37	Perform post-test activities			
38	RRFMC data analysis and test report.			

SAVY 5QT 01130500GB (LID) — 03130513S2

3RD PULSE THIS LID - see p.88 logbook for 1ST & 2ND.

	Date: 9-24-2020	Assistant 2: DAVIS.	
	Logbook: RMCFILT-6-MOORE p.92	Assistant 3:	
	Operator 1: MOORE	Assistant 4:	
	Note: Only record the operator number after completion of the step.		

Z:\RTG in a Can - 30 psig test\[Punchlist - RTG in a Can - 30 psig - R2.xlsx]Sheet1

Tower & container cleaning steps

	Preliminary Steps	Note	Operator number*	Assistant number
1	Spray silicone into HEPA cabinet & generic mixer	Optional		
2	Wipe RRFMC floor with clean cotton cloth			
3	Wipe the test container with a damp paper towel			
4				

Third SAVY Test

Third SAVY Test

4TH BUT NOTE NEW DIFFERENT CAN

1ST – SAVY-5QT – Ø12Ø05142L (LID) New pressurized powder punchlist.

Operation procedure punchlist and container information sheet. (RTG in a can - 30 psig series)

	Preliminary Steps	Note	Operator number	Assistant number
1	Walk through room 103 and organize work area.		1	
2	Record the date, operator, logbook name & page.		1	
3	Record serial number and volume of test can.		1	
4	Note room temp (deg F). (74)	Moore MB2010	1	
5	Open Z:\RTG in a Can - 30 psig test\RTG in a Can - 30 psig - R1.xlsx. test.xlsx		– from previous test	
6	Calculate charging pressure for gray 9 gallon Drierite 106-C vessel for 30 psig pulse. 34		1	
7	Note charging pressure (psig): 34	Pressure (psig): 34	1	
8	Ensure vessel 106-C will not initially be pressure charged.			
9	Note valve V5 is open, to not charge vessel 106-C.		1	
10	Note valve V6 is closed, to not charge vessel 106-C.		1	
	In Process Steps			
11	Prepare container to be tested.			2
12	Install test can above ball valve on vessel 106-C.			2
13	Close and lock tower door. Seal with "In Use" yellow tape.			2
14				
15	Turn on air compressor.			2
16	Adjust regulator PCV1 and use PRV1 to set and note charging pressure: if needed			
17	Set and record wind tunnel speed (Hz): 24 Hz		1	~~2~~
18				
19	Note valve V5 is closed, to charge vessel 106-C.		1	
20	Note valve V6 is open, to charge vessel 106-C.		1	
21	Verify gray vessel Drierite 106-C is pressurized.		1	
22	Verify charging (system) pressure on PI3: 33	Pressure (psig): 33		
23	BKG: 2×10^{-5}; 3×10^{-5};			
24	Turn aerosol particle counter on.		1	
25	Start AIM software for drop test sampling (60 sec count, 90 count cycles)		1	
26	Pre-drop BKG concentration validation. Note five cycles of 1 minute.		1	
27	Create filename: Logbook – test series – FD info			
28	Toggle ball valve above gray vessel Drierite 106-C for a one to two second pulse.			
29	Note sample number of aerosol particle counter. 10th	Sample number at pulse: 10th	1	
30	(11th) 3×10^{-5} mg/m^3;			
	Post-test Steps			
31	Save data files, record file names and location		1	
32	Verify background is about 1.0E-5 mg/m^3 before opening door.			
33	Open RRFMC door			
34	(Optional) DR measurement			
35	(Optional) DR Measurement filter.			
36	Turn air compressor off – open bleed valve.			
37	Perform post-test activities			
38	RRFMC data analysis and test report.			
	SAVY 5QT Ø12Ø05142L 1ST			
	Date: 9-24-2020	Assistant 2: DAVIS		
	Logbook: pg 93 NUCFILT-6-Moore	Assistant 3:		
	Operator 1: Moore	Assistant 4:		
	Note: Only record the operator number after completion of the step.			

Z:\RTG in a Can - 30 psig test\[Punchlist - RTG in a Can - 30 psig - R2.xlsx]Sheet1

Tower & container cleaning steps

	Preliminary Steps	Note	Operator number*	Assistant number
1	Spray silicone into HEPA cabinet & generic mixer	Optional		
2	Wipe RRFMC floor with clean cotton cloth			
3	Wipe the test container with a damp paper towel			
4				

Fourth SAVY Test

Fourth SAVY test

5TH BUT NOTE NEW DIFFERENT CAN

2ND - SAV4 5QT - 0120051421 - New pressurized powder punchlist.

Operation procedure punchlist and container information sheet: (RTG in a can - 30 psig series)

	Preliminary Steps	Note	Operator number	Assistant number
1	Walk through room 103 and organize work area.		1	
2	Record the date, operator, logbook name & page.		1	
3	Record serial number and volume of test can.		1	
4	Note room temp (deg F). 80	MOORE ME 2020		
5	Open Z:\RTG in a Can - 30 psig test\RTG in a Can - 30 psig ~~R1.xlsx~~ test.xlsx		1	
6	Calculate charging pressure for gray 9 gallon Drierite 106-C vessel for 30 psig pulse. 34			
7	Note charging pressure (psig):	Pressure (psig): 34		
8	Ensure vessel 106-C will not initially be pressure charged.			
9	Note valve V5 is open, to not charge vessel 106-C.		1	
10	Note valve V6 is closed, to not charge vessel 106-C.		1	
	In Process Steps			
11	Prepare container to be tested.		1	2
12	Install test can above ball valve on vessel 106-C.		1	2
13	Close and lock tower door. Seal with "In Use" yellow tape.		1	2
14				
15	Turn on air compressor.		1	2
16	Adjust regulator PCV1 and use PRV1 to set and note charging pressure.	if needed.	1	2
17	Set and record wind tunnel speed (Hz):	27 Hz	1	
18				
19	Note valve V5 is closed, to charge vessel 106-C.		1	2
20	Note valve V6 is open, to charge vessel 106-C.		1	2
21	Verify gray vessel Drierite 106-C is pressurized.			2
22	Verify charging (system) pressure on PI3: 33	Pressure (psig): 33	1	2
23	create filename -			
24	Turn aerosol particle counter on.		1	
25	Start AIM software for drop test sampling (60 sec count, 90 count cycles) 2:50PM		1	
26	Pre-drop BKG concentration validation. Note five cycles of 1 minute.		1	
27	;2x10^-4;8x10^-6; ;1x10^-6			
28	Toggle ball valve above gray vessel Drierite 106-C for a one to two second pulse.		1	
29	Note sample number of aerosol particle counter. 6M	Sample number at pulse: 6M	1	
30				
	Post-test Steps			
31	Save data files, record file names and location		1	
32	Verify background is about 1.0E-5 mg/m^3 before opening door.		1	
33	Open RRFMC door			
34	(Optional) DR measurement			
35	(Optional) DR Measurement filter.			
36	Turn air compressor off - open bleed valve			
37	Perform post-test activities			
38	RRFMC data analysis and test report.			
	SAV4 5QT - 0120051421 2ND			
	Date: 9/24-2020	Assistant 2: Dewit.		
	Logbook: p.93 NRC fil-6-Moore.	Assistant 3:		
	Operator 1: Moore	Assistant 4:		
	Note: Only record the operator number after completion of the step.			

Z:\RTG in a Can - 30 psig test\[Punchlist - RTG in a Can - 30 psig - R2.xlsx]Sheet1

Tower & container cleaning steps

	Preliminary Steps	Note	Operator number*	Assistant number
1	Spray silicone into HEPA cabinet & generic mixer	Optional		
2	Wipe RRFMC floor with clean cotton cloth			
3	Wipe the test container with a damp paper towel			
4				

Fifth SAVY Test

Fifth SAVY test

6TH BUT NOTE NEW DIFFERENT CAN
3rd - NucFilt Cans - 6 - Moore #3 93 - 5QT SAV4 - 30 psig - 012005142L.A21 Using new punchlist.

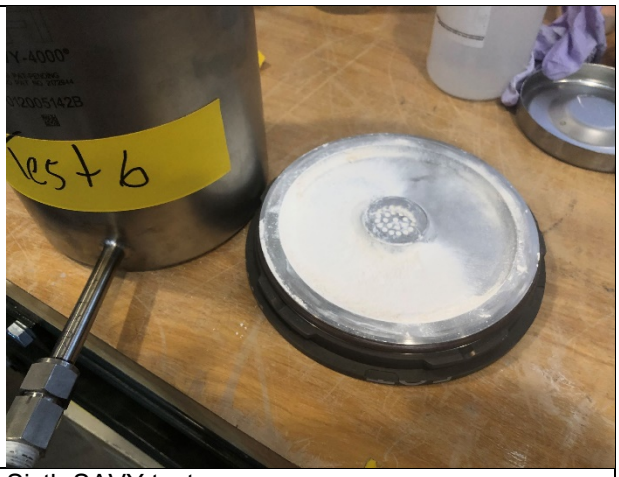
Operation procedure punchlist and container information sheet: (RTG in a can - 30 psig series)

	Preliminary Steps	Note	Operator number	Assistant number
1	Walk through room 103 and organize work area.		1	
2	Record the date, operator, logbook name & page.		1	
3	Record serial number and volume of test can.	5QT SAV4 LLD 012005142L	1	
4	Note room temp (deg F).	78	1	
5	Z:\RTG in a Can - 30 psig test\Moore ME 2020 RTG in a Can - 30 psig test.xlsx			
6	Calculate charging pressure for gray 9 gallon Drierite 106-C vessel for 30 psig pulse.	34	1	
7	Note charging pressure (psig):	Pressure (psig): 34	1	
8	Ensure vessel 106-C will not initially be pressure charged.			
9	Note valve V5 is open, to not charge vessel 106-C.		1	
10	Note valve V6 is closed, to not charge vessel 106-C.		1	
	In Process Steps			
11	Prepare container to be tested.		1	
12	Install test can above ball valve on vessel 106-C.		1	
13	Close and lock tower door. Seal with "In Use" yellow tape.		1	
14				
15	Turn on air compressor.		1	
16	Adjust regulator PCV1 and use PRV1 to set charging pressure, if needed:		1	
17	Set and record wind tunnel speed (Hz):	24 Hz		
18				
19	Note valve V5 is closed, to charge vessel 106-C.		1	
20	Note valve V6 is open, to charge vessel 106-C.		1	
21	Verify gray vessel Drierite 106-C is pressurized.		1	
22	Verify charging (system) pressure on PI3:	Pressure (psig): 33	1	
23	Turn aerosol particle counter on.		1	
24	Create filename with format: Logook and page, test series and ID info.		1	
25	Start AIM software for drop test sampling (60 sec count, 90 count cycles)		1	
26	Pre-drop BKG concentration validation. Note five cycles of 1 minute.	3×10^{-4};		
27	2×10^{-5}; 2×10^{-5}; 1×10^{-5} ok		1	
28	Toggle ball valve above gray vessel Drierite 106-C for a one to two second pulse.			
29	Note sample number of aerosol particle counter. 7th	Sample number at pulse: 7th	1	
30	#25 = 9×10^{-7} mg/m3			
	Post-test Steps			
31	Save data files, record file names and location			
32	Verify background is about 1.0E-5 mg/m^3 before opening door.			
33	Open RRFMC door			
34	(Optional) DR measurement			
35	(Optional) DR Measurement filter.			
36	Turn air compressor off and open bleed valve.			
37	Perform post-test activities			
38	RRFMC data analysis and test report.			
	Date: 9-24-2020	Assistant 2: DAVIS		
	Logbook: P. 93 NUCFILT 6-MOORE	Assistant 3:		
	Operator 1: MOORE	Assistant 4:		
	Note: Only record the operator number after completion of the step.			

Z:\RTG in a Can - 30 psig test\[Punchlist - RTG in a Can - 30 psig - R2.xlsx]Sheet1

Tower & container cleaning steps

	Preliminary Steps	Note	Operator number*	Assistant number
1	Spray silicone into HEPA cabinet & generic mixer	Optional		
2	Wipe RRFMC floor with clean cotton cloth			
3	Wipe the test container with a damp paper towel			
4				

	
Sixth SAVY test	Sixth SAVY test

1ST HAGAN 8QT CAN Ø8-Ø6-Ø8154 LID Ø9-Ø6-LANL 559

Operation procedure punchlist ~~8 QT~~ Hagan @ 30psig pulse 8 100 g CeO2

	Preliminary Steps LANL-559 Ø9-Ø6 FILTER # NUCFIL-013 — noted 9-28-30 20	Note — 3/8" DIA	Operator number*	Assistant number
1	Walk through room 103 and organize work area.		1	
2	Record the date, operator, logbook name & page.		1	
3	Turn on air compressor.		1	
4	Set up hi-speed cameras. N/A	—		
5	Set up room AC. 70°F Sept 22, 2020 N/A	—		
6	(optional) Set up AC/heater in wind tunnel test section.	N/A		
7	(optional) Set up humidifier. N/A	—		
8	Record TA-6 outdoor temp and RH% (optional). N/A	—		
9	Prepare container to be tested, put fiducial makers on. N/A	—		
	In Process Steps			
10	~~Load item on platen in test orientation.~~	Loaded Hagan on top of Drierite 106-C		
11	Take picture and ~~measure angle~~ of test item.		1	
12	Close and lock tower door.		1	
13	Set wind tunnel speed. 24Hz			
14	Record air velocity & flow rate at location #4. N/A	@ 24 Hz		
15	Record tunnel temperature and RH%. N/A			
16	Turn aerosol particle counter on.		1	
17	Start AIM software for drop test sampling.		1	
18	Pre-drop BKG concentration validation.			
19	Undo ~~lockout and turn on drop tester switch~~ N/A		*	
20	Sweep room 103 for other personnel N/A		*	
21	Exit room 103, close door and set safety signs. N/A		*	
22	Determine needed value for measuring tape. N/A		*	
23	Note tape height T, and net height H. N/A		*	
24	Raise platen to tape height, T (net height, H). N/A		*	
25	~~Drop the load.~~ open valve for 30 psig test		*	
26	Trigger hi-speed cameras			
27	Turn off drop tester at remote control.		*	
28	Re-install the lockout lock.		*	
29	Note sample number of aerosol particle counter.			
30	Background concentration validation			
	Post-test Steps			
31	Reset drop tester			
32	Save data files, record file names and location			
33	~~Open RRFMC door~~	100g CeO2 LOAD (MAR)		
34	~~(Optional) DR measurement~~	98.4g remain in can - but loosely removed		
35	(Optional) DR Measurement filter.	1.6g Remain on lid/filter/interior stuck-sticky		
36	Turn air compressor off			
37	Perform post-test activities	Photo of 1.6g of CeO2 on orange beaker lid for comparison.		
38	RRFMC data analysis and test report.			

Z:\Drop tester - RRFMC\Operation procedure\RP-SVS-RIC-TR-100-R1 RRFMC updated procedure 2020\[RRFMC punch list -2020.xlsx]Sheet1

These tasks(*) are to be performed only by the designated operator for physical control of the key.

	Date: 9-22-2020	Assistant 2: Davis.
	Logbook: NucFilt-6-Moore p. 87	Assistant 3:
	Operator 1: Moore	Assistant 4:
	Note: Only record the operator number after completion of the step.	

	
First Hagan test	First Hagan test

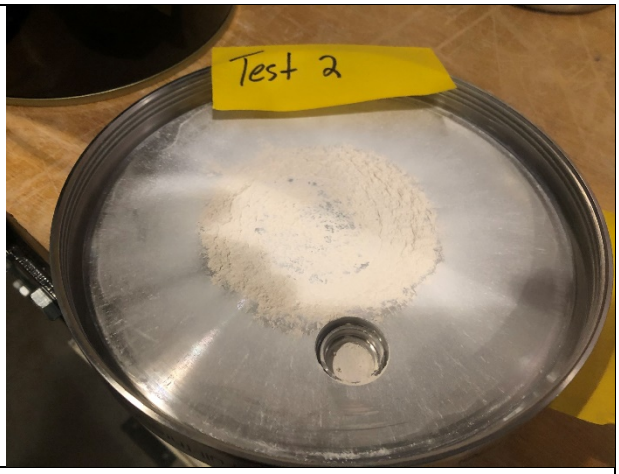
8 QT Hagan @ 30 PSIG pulse series 2ND HAGAN 8QT

Operation procedure punchlist and container information sheet. (RTG in a can - 30 psig series)

	Preliminary Steps	Note	Operator number	Assistant number
1	Walk through room 103 and organize work area.			2
2	Record the date, operator, logbook name & page.			2
3	Record serial number and volume of test can.			2
4	Note room temp (deg F). 67°F			
5	Z:\RTG in a Can - 30 psig test\Moore ME 2020 RTG in a Can - 30 psig test.xlsx			
6	Calculate charging pressure for gray 9-gallon Drierite 106-C vessel for 30 psig pulse.			2
7	Note charging pressure (psig): 37 PSIG	Pressure (psig):		
8	Ensure vessel 106-C will not initially be pressure charged.			
9	Note valve V5 is open, to not charge vessel 106-C.			2
10	Note valve V6 is closed, to not charge vessel 106-C.			2
	In Process Steps			
11	Prepare container to be tested.		1	X
12	Install test can above ball valve on vessel 106-C.		1	
13	Close and lock tower door. Seal with "In Use" yellow tape.		1	
14				
15	Turn on air compressor.			2
16	Adjust regulator PCV1 and use PRV1 to set charging pressure, if needed: 36 psig			
17	Set and record wind tunnel speed (Hz): 24.0			2
18				
19	Note valve V5 is closed, to charge vessel 106-C.			2
20	Note valve V6 is open, to charge vessel 106-C.			2
21	Verify gray vessel Drierite 106-C is pressurized.			2
22	Verify charging (system) pressure on PI3: 36 psig	Pressure (psig): 36 psig		
23	Turn aerosol particle counter on. 12:19 PM			2
24	Create filename with format: Logook and page, test series and ID info. NucFiltCan-6-Moore p.94-8QT Hagan-filter			
25	Start AIM software for drop test sampling (60 sec count, 90 count cycles) NUCFIL-019 2-08 LANL2143. A21			
26	Pre-drop BKG concentration validation. Note five cycles of 1 minute. 1.48×10^{-8} mg/m^3,			
27	9×10^{-6}, 3.6×10^{-7}, 0.0, 7.5×10^{-7}, 6.1×10^{-7}			
28	Toggle ball valve above gray vessel Drierite 106-C for a one to two second pulse.			
29	Note sample number of aerosol particle counter. #7	Sample number at pulse: #7		
30	(7) 0.491 mg/m^3,			
	Post-test Steps			
31	Save data files, record file names and location			
32	Verify background is about 1.0E-5 mg/m^3 before opening door.			
33	Open RRFMC door			
34	(Optional) DR measurement			
35	(Optional) DR Measurement filter.			
36	Turn air compressor off and open bleed valve.			
37	Perform post-test activities			
38	RRFMC data analysis and test report.			
	HAGAN CAN 08-06-08154			
	FILTER NUCFIL-019 2-08 LANL 2143	3/8" DIA TORQUE 10.6 LBF.		
	Date: 9-28-2020	Assistant 2: MOORE		
	Logbook: NUCFIL-6-MOORE PG. 94	Assistant 3:		
	Operator 1: ~~MOORE~~ DAVIS	Assistant 4:		
	Note: Only record the operator number after completion of the step.			

Tower & container cleaning steps

	Preliminary Steps	Note	Operator number*	Assistant number
1	Spray silicone into HEPA cabinet & generic mixer	Optional		
2	Wipe RRFMC floor with clean cotton cloth			
3	Wipe the test container with a damp paper towel			
4				

	
Second Hagan test	Second Hagan test

RTG in a CAN test name series 3RD HAGAN 8 QT

Operation procedure punchlist and container information sheet. (RTG in a can - 30 psig series)

	Preliminary Steps	Note	Operator number	Assistant number
1	Walk through room 103 and organize work area.			2
2	Record the date, operator, logbook name & page.			2
3	Record serial number and volume of test can.			2
4	Note room temp (deg F).			
OPEN 5	Z:\RTG in a Can - 30 psig test\Moore ME 2020 RTG in a Can - 30 psig test.xlsx			2
6	Calculate charging pressure for gray 9 gallon Drierite 106-C vessel for 30 psig pulse.	37 psig		
7	Note charging pressure (psig): 37 psig target	Pressure (psig):		
8	Ensure vessel 106-C will not initially be pressure charged.			
9	Note valve V5 is open, to not charge vessel 106-C.		1	
10	Note valve V6 is closed, to not charge vessel 106-C.		1	
	In Process Steps			
11	Prepare container to be tested.		1	
12	Install test can above ball valve on vessel 106-C.		1	
13	Close and lock tower door. Seal with "In Use" yellow tape.		1	
14				
15	Turn on air compressor.		1	
16	Adjust regulator PCV1 and use PRV1 to set charging pressure, if needed:		1	
17	Set and record wind tunnel speed (Hz): 24 Hz			2
18				
19	Note valve V5 is closed, to charge vessel 106-C.		1	
20	Note valve V6 is open, to charge vessel 106-C.		1	
21	Verify gray vessel Drierite 106-C is pressurized.		1	
22	Verify charging (system) pressure on PI3: ~~37 psig~~ OK	Pressure (psig): ~~38 PSIG~~ 37 PSIG		
23	Turn aerosol particle counter on.			2
24	Create filename with format: Logook and page, test series and ID info. pg.95 - 8 QT Hagan - Filter NUCFIL-019 208 LANL 3012.			
25	Start AIM software for drop test sampling (60 sec count, 90 count cycles) 3:33PM			
26	Pre-drop BKG concentration validation. Note five cycles of 1 minute.			
27				
28	Toggle ball valve above gray vessel Drierite 106-C for a one to two second pulse.			
29	Note sample number of aerosol particle counter.	Sample number at pulse: #11		
30	(11) 9.7×10^{-2}; (12) 5.6×10^{-2} mg/m³; 2.1×10^{-2};	(#60) 2.4×10^{-4}		
	Post-test Steps			
31	Save data files, record file names and location			
32	Verify background is about 1.0E-5 mg/m^3 before opening door.			
33	Open RRFMC door			
34	(Optional) DR measurement			
35	(Optional) DR Measurement filter.			
36	Turn air compressor off and open bleed valve.			
37	Perform post-test activities			
38	RRFMC data analysis and test report.			
	HAGAN-CAN-08-06-08154			
	FILTER NUCFIL-019 208 LANL 3012	5/8" DIA FILTER; 10.6 LBF TORQUE		
	Date: 9-28-2020	Assistant 2: MOORE		
	Logbook: p.95 NUCFIL-6-MOORE	Assistant 3:		
	Operator 1: DAVIS	Assistant 4:		
	Note: Only record the operator number after completion of the step.			

5.0% fluorescein - reconcile this to pg.95 L06

Z:\RTG in a Can - 30 psig test\[Punchlist - RTG in a Can - 30 psig - R2.xlsx]Sheet1

Tower & container cleaning steps

	Preliminary Steps	Note	Operator number*	Assistant number
1	Spray silicone into HEPA cabinet & generic mixer	Optional		
2	Wipe RRFMC floor with clean cotton cloth			
3	Wipe the test container with a damp paper towel			
4				

	
Third Hagan test	Third Hagan test

TEST 4TH HAGAN

Operation procedure punchlist and container information sheet. (RTG in a can - 30 psig series)

	Preliminary Steps	Note	Operator number	Assistant number
1	Walk through room 103 and organize work area.		1	
2	Record the date, operator, logbook name & page.			2
3	Record serial number and volume of test can.			2
4	Note room temp (deg F). 68°F			2
5	Z:\RTG in a Can - 30 psig test\Moore ME 2020 RTG in a Can - 30 psig test.xlsx			~~2~~
6	Calculate charging pressure for gray 9 gallon Drierite 106-C vessel for 30 psig pulse.			2
7	Note charging pressure (psig): 37 PSIG	Pressure (psig): 37 PSIG		2
8	Ensure vessel 106-C will not initially be pressure charged.		1	~~2~~
9	Note valve V5 is open, to not charge vessel 106-C.		1	2
10	Note valve V6 is closed, to not charge vessel 106-C.			
	In Process Steps			
11	Prepare container to be tested. 100.0 g CeO2 + 5% by wt. fluorescent			
12	Install test can above ball valve on vessel 106-C		1	
13	Close and lock tower door. Seal with "In Use" yellow tape.		1	
14				
15	Turn on air compressor.		1	
16	Adjust regulator PCV1 and use PRV1 to set charging pressure, if needed:			
17	Set and record wind tunnel speed (Hz):	~~24~~ 48		
18				
19	Note valve V5 is closed, to charge vessel 106-C.		1	
20	Note valve V6 is open, to charge vessel 106-C.		1	
21	Verify gray vessel Drierite 106-C is pressurized.		1	
22	Verify charging (system) pressure on PI3: ———	Pressure (psig): 38 PSIG	1	
23	Turn aerosol particle counter on.			2
24	Create filename with format: Logook and page, test series and ID info.			2
25	Start AIM software for drop test sampling (60 sec count, 90 count cycles) 11:44 AM			2
26	Pre-drop BKG concentration validation. Note five cycles of 1 minute. 6.3×10^{-5} mg/m^3;			2
27	———; ———; 2.2×10^{-5} mg/m3; 7.3×10^{-6}			2
28	Toggle ball valve above gray vessel Drierite 106-C for a one to two second pulse.		1	
29	Note sample number of aerosol particle counter. 6TH	Sample number at pulse: 6TH ✓		2
30	PEAK: (6TH) 5.5×10^{-2} mg/m3 (7) (8) 9×10^{-3} (9) 4×10^{-3} (10) 3×10^{-3}			(3)
	Post-test Steps			
31	Save data files, record file names and location			
32	Verify background is about 1.0E-5 mg/m^3 before opening door. (#43) 3×10^{-5} (STOP)			2
33	Open RRFMC door			
34	(Optional) DR measurement			
35	(Optional) DR Measurement filter.			
36	Turn air compressor off and open bleed valve.		1	
37	Perform post-test activities			
38	RRFMC data analysis and test report.			
	8QT HAGAN - 08-06 - 08154	5/8" DIA; 10.0 LBF TORQUE.		
	FILTER: NUCFIL-019 2-08 LANL3029			
	Date: 9-29-2020	Assistant 2: MOORE		
	Logbook: P6.96 NUCFILT-6-Moore	Assistant 3:		
	Operator 1: DAVIS	Assistant 4:		
	Note: Only record the operator number after completion of the step.			

Z:\RTG in a Can - 30 psig test\[Punchlist - RTG in a Can - 30 psig - R2.xlsx]Sheet1

Tower & container cleaning steps

	Preliminary Steps	Note	Operator number*	Assistant number
1	Spray silicone into HEPA cabinet & generic mixer	Optional		
2	Wipe RRFMC floor with clean cotton cloth			
3	Wipe the test container with a damp paper towel			
4				

	
Fourth Hagan test	Fourth Hagan test

5TH HAGAN TEST

Operation procedure punchlist and container information sheet. (RTG in a can - 30 psig series)

	Preliminary Steps	Note	Operator number	Assistant number
1	Walk through room 103 and organize work area.		1	
2	Record the date, operator, logbook name & page.			2
3	Record serial number and volume of test can.			2
4	Note room temp (deg F). 72° F			2
5	Z:\RTG in a Can - 30 psig test\Moore ME 2020 RTG in a Can - 30 psig test.xlsx			2
6	Calculate charging pressure for gray 9 gallon Drierite 106-C vessel for 30 psig pulse.			
7	Note charging pressure (psig): ———	Pressure (psig): 37 PSIG		
8	Ensure vessel 106-C will not initially be pressure charged.		1	
9	Note valve V5 is open, to not charge vessel 106-C.		1	
10	Note valve V6 is closed, to not charge vessel 106-C.		1	
	In Process Steps			
11	Prepare container to be tested.		1	
12	Install test can above ball valve on vessel 106-C.		1	
13	Close and lock tower door. Seal with "In Use" yellow tape.		1	
14				
15	Turn on air compressor.		1	
16	Adjust regulator PCV1 and use PRV1 to set charging pressure, if needed:			
17	Set and record wind tunnel speed (Hz): 24 Hz.		1	
18				
19	Note valve V5 is closed, to charge vessel 106-C.		1	
20	Note valve V6 is open, to charge vessel 106-C.		1	
21	Verify gray vessel Drierite 106-C is pressurized.		1	
22	Verify charging (system) pressure on PI3: 36 PSIG	Pressure (psig): ———	1	2
23	Turn aerosol particle counter on.		1	2
24	Create filename with format: Logook and page, test series and ID info.			2
25	Start AIM software for drop test sampling (60 sec count, 90 count cycles) 1:16 PM			2
26	Pre-drop BKG concentration validation. Note five cycles of 1 minute. 7.2×10^{-5};			
27		(MH) 4.2×10^{-6}; 1.7×10^{-6}; 1.4×10^{-5}		2
28	Toggle ball valve above gray vessel Drierite 106-C for a one to two second pulse.			
29	Note sample number of aerosol particle counter (7M)	Sample number at pulse: (7)		
30	(7M) 0.126 mg/m3; 4.0×10^{-2}			
	Post-test Steps			
31	Save data files, record file names and location			
32	Verify background is about 1.0E-5 mg/m^3 before opening door.			
33	Open RRFMC door			
34	(Optional) DR measurement			
35	(Optional) DR Measurement filter.			
36	Turn air compressor off and open bleed valve.			
37	Perform post-test activities			
38	RRFMC data analysis and test report.			
	FILTER NUCFIL-0813 10-02 LANL 2062 3/8" DIA FILTER. 10.4 LBF TORQUE			
	Date: 9-29-2020	Assistant 2:		
	Logbook: NucFil-6-Moore, pg. 97	Assistant 3:		
	Operator 1:	Assistant 4:		
	Note: Only record the operator number after completion of the step.			

Z:\RTG in a Can - 30 psig test\[Punchlist - RTG in a Can - 30 psig - R2.xlsx]Sheet1

Tower & container cleaning steps

	Preliminary Steps	Note	Operator number*	Assistant number
1	Spray silicone into HEPA cabinet & generic mixer	Optional		
2	Wipe RRFMC floor with clean cotton cloth			
3	Wipe the test container with a damp paper towel			
4				

	
Fifth Hagan test	Fifth Hagan test

6TH HAGAN TEST

Operation procedure punchlist and container information sheet. (RTG in a can - 30 psig series)

	Preliminary Steps	Note	Operator number	Assistant number
1	Walk through room 103 and organize work area.		1	
2	Record the date, operator, logbook name & page.			2
3	Record serial number and volume of test can.			2
4	Note room temp (deg F). 70°F			2
5	Z:\RTG in a Can - 30 psig test\Moore ME 2020 RTG in a Can - 30 psig test.xlsx			2
6	Calculate charging pressure for gray 9 gallon Drierite 106-C vessel for 30 psig pulse.			2
7	Note charging pressure (psig): 37 PSIG	Pressure (psig):		2
8	Ensure vessel 106-C will not initially be pressure charged.		1	
9	Note valve V5 is open, to not charge vessel 106-C.		1	
10	Note valve V6 is closed, to not charge vessel 106-C.		1	
	In Process Steps			
11	Prepare container to be tested.		1	
12	Install test can above ball valve on vessel 106-C.		1	
13	Close and lock tower door. Seal with "in Use" yellow tape.		1	
14				
15	Turn on air compressor.		1	
16	Adjust regulator PCV1 and use PRV1 to set charging pressure, if needed:			
17	Set and record wind tunnel speed (Hz): 24 Hz			
18				
19	Note valve V5 is closed, to charge vessel 106-C.		1	
20	Note valve V6 is open, to charge vessel 106-C.		1	
21	Verify gray vessel Drierite 106-C is pressurized. ✓		1	
22	Verify charging (system) pressure on PI3:	Pressure (psig): 36 PSIG	1	2
23	Turn aerosol particle counter on.			
24	Create filename with format: Logook and page, test series and ID info.			2
25	Start AIM software for drop test sampling (60 sec count, 90 count cycles) 2:43PM			2
26	Pre-drop BKG concentration validation. Note five cycles of 1 minute. 8.4×10^{-7}; 1.3×10^{-6}			2
27	5.6×10^{-7} mg/m³; 4×10^{-6}; 5.8×10^{-6}			2
28	Toggle ball valve above gray vessel Drierite 106-C for a one to two second pulse.		1	
29	Note sample number of aerosol particle counter. 7m	Sample number at pulse: 7m		
30	0.180 mg/m³; 5.1×10^{-2}; 9.4×10^{-3}; 3.8×10^{-3}; (#11) 2.5×10^{-3} mg/m³			
	Post-test Steps			
31	Save data files, record file names and location			
32	Verify background is about 1.0E-5 mg/m^3 before opening door. (41) 1.7×10^{-5}			2
33	Open RRFMC door			
34	(Optional) DR measurement			
35	(Optional) DR Measurement filter.			
36	Turn air compressor off and open bleed valve.			
37	Perform post-test activities			
38	RRFMC data analysis and test report.			
	FILTER: NUCFIL-013 10-02 2213	DIA: 3/8" TORQUE: 10.4 LBF		
	Date:	Assistant 2:		
	Logbook: Nuc-Fil-6- Moore. pg. 98	Assistant 3:		
	Operator 1:	Assistant 4:		
	Note: Only record the operator number after completion of the step.			

Z:\RTG in a Can - 30 psig test\[Punchlist - RTG in a Can - 30 psig - R2.xlsx]Sheet1

BKG WIPE OF LID TOP & CAN BODY BELOW LID.

Tower & container cleaning steps

	Preliminary Steps	Note	Operator number*	Assistant number
1	Spray silicone into HEPA cabinet & generic mixer	Optional		
2	Wipe RRFMC floor with clean cotton cloth			
3	Wipe the test container with a damp paper towel			
4				

	
Sixth Hagan test	Sixth Hagan test

Files to locate metadata information.

1) "Z:\RTG in a Can - 30 psig test\ Moore ME and JT Davis 11-19-20 Pressurizing Hagan and SAVY containers to 30-psig (air).docx"
2) "Z:\RTG in a Can - 30 psig test\Excel calcs\RTG in a can - summary of tests 11-10-20 R1.xlsx
3) Z:\RTG in a Can - 30 psig test\Excel calcs\NucFilt Cans-6 Moore pg 86 - 2 Gal Cary 37 psig - 1 mm hole in lid.xlsx
4) (1st SAVY) RRFMC for NucFilt Cans-6 Moore pg 88 - 5 QT SAVY - 30 psig - 100 g CeO2 - template Oct 2020.xlsx
5) (2nd SAVY) - NucFilt Cans-6 Moore pg 88 - 5 QT SAVY - 30 psig - 100 g CeO2.xlsx
6) (3rd SAVY) - NucFilt Cans-6 Moore pg 92 - 5 QT SAVY - 30 psig - 100 g CeO2.xlsx
7) (4th SAVY) - NucFilt Cans-6 Moore pg 93 - 5 QT SAVY - 30 psig - 012005142L.xlsx
8) (5th SAVY) - NucFilt Cans-6 Moore pg 93 - 5 QT SAVY - 30 psig - 012005142L.xlsx
9) (6th SAVY) - NucFilt Cans-6 Moore pg 93 - 5 QT SAVY - 30 psig - 012005142L.xlsx
10) (2nd Hagan 0.625-dia) NucFilt Cans-6 Moore pg 94 - 8 QT Hagan - filter NUCFIL-019 2-08 LANL 2143 - RRFMC template Oct 2020.xlsx
11) (3rd Hagan 0.625-dia) NucFilt Cans-6 Moore pg 95 - 8 QT Hagan - filter NUCFIL-019 2-08 LANL 3012.txt
12) (4th Hagan 0.625-dia) NucFilt Cans-6 Moore pg 96 - 8 QT Hagan - filter NUCFIL-019 2-08 LANL 3029.txt
13) (1st Hagan 0.375-dia) NucFilt Cans-6 Moore pg 87 - 8 QT Hagan - 30 psig - 100 g CeO2.xlsx
14) (5th Hagan 0.375-dia) NucFilt Cans-6 Moore pg 97 - 8 QT Hagan - filter NUCFIL-013 10-02 LANL 2062.txt
15) (6th Hagan 0.375-dia) NucFilt Cans-6 Moore pg 98 - 8 QT Hagan - filter NUCFIL-013 10-02 LANL 2213.txt